

*EFFECTS OF RESPONSE CARDS DURING LESSON  
CLOSURE ON THE ACADEMIC PERFORMANCE OF  
SECONDARY STUDENTS IN AN EARTH SCIENCE COURSE*

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This study evaluated the effects of two review techniques on secondary students' recall of science lesson content: (a) an active review condition in which students used response cards to answer questions, and (b) a passive review condition in which students looked and listened while the teacher projected and read key lesson points. Scores on next-day and weekly tests were higher on lesson content reviewed with response cards.

DESCRIPTORS: academic behavior, education, group instruction, response cards, teaching

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Previous research has shown response cards—cards, signs, or other conveyances simultaneously held up by all students in the class to display their responses to a teacher-presented question or problem—to be an effective way of increasing student participation and learning when compared to the one-student-answering-at-a-time method of participation during whole-class instruction (Gardner, Heward, & Grossi, 1994; Heward, 1994). This study extends previous research on response cards by investigating their effects during end-of-lesson reviews on

recall of lesson content by high school students with and without disabilities.

## METHOD

### *Subjects and Setting*

The study was conducted in an earth science course in a large suburban public high school. Participants were 23 ninth-grade students, 8 of whom had been formally identified as having learning disabilities, behavior disorders, or mental retardation, or who were enrolled in supplementary programs for students at risk for not completing high school.

### *Dependent Variables*

An alternating treatments design was used to analyze the differential effects of two review conditions on students' responses on next-day and weekly tests. Data were obtained from responses to fill-in-the-blank questions on 30 12-item next-day tests and

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11 42-item weekly tests. Test questions were taken directly from instructional content presented during each class session and explicitly reviewed at each session's conclusion. Next-day tests contained all of the key points from the previous day's lesson and were administered at the start of each class session. Weekly tests, comprised of content selected from the preceding 2 weeks' lessons, were administered on the last school day of each week beginning with Week 2 of the study.

#### *Interobserver Agreement*

Two independent observers scored 17 next-day and four weekly tests from all students. Mean interobserver agreement for all tests, calculated on a question-by-question basis, was 99.3% (range, 97.7% to 100%). Two independent observers completed a procedural checklist for 29 of the study's sessions, with 100% agreement for treatment fidelity.

#### *General Procedures*

Selection of lesson content followed the sequence of topics in the text used in the course. After selecting specific lesson content on the basis of equivalent difficulty and novelty, 12 facts or key points were randomly assigned to each session across review conditions and formats. Each 30-min science lesson consisted of three parts: (a) lecture, in which the teacher explained and progressively disclosed each point; (b) hands-on demonstration or experiment; and (c) teacher-led review of lesson content.

*Passive review.* Passive review consisted of the teacher reading each key point once while progressively disclosing it on an overhead projector. Each key point combined a term, concept, or process with its definition and was expressed as a complete sentence (e.g., Metamorphic rock has been changed by heat or pressure). After presenting each point, the teacher provided examples or ad-

ditional explanations for that point before proceeding to the next item.

*Response card review.* The teacher also progressively disclosed and read each key point in the response card review condition, but each key point had a blank in place of the term, concept, or process (e.g., rock has been changed by heat and pressure). Students wrote a word on their response cards to complete the point and, on the teacher's cue, "Cards up," held their response cards above their heads. After surveying the responses of the class, the teacher disclosed the correct answer (e.g., metamorphic) on his transparency, provided praise or correction, then immediately presented the next key point for review.

*Review formats.* The active and passive review conditions were compared in three different phases: (a) a  $1 \times 12$  format in which 12 lesson points were reviewed once each, (b) a  $2 \times 12$  format in which 12 lesson points were reviewed twice each, and (c) a  $2 \times 6$  review format in which a total of 12 lesson points, 6 points with response card review and 6 points with passive review, were reviewed twice each.

## RESULTS AND DISCUSSION

#### *Next-Day Tests*

Figure 1 displays the mean percentage of next-day test items that were answered correctly by all students in the class. Mean next-day test scores by 13 of the 15 general education students and all 8 of the special education students were higher for key points reviewed with response cards than for key points reviewed with the passive procedure. Mean percentage correct on next-day tests for the entire class for items reviewed with the passive and response card procedures, respectively, were 30.4% and 42.2% during the  $1 \times 12$  review, 25.2% and 48.5% during the  $2 \times 12$  review, and 18.5% and 36.1% during the  $2 \times 6$  review.

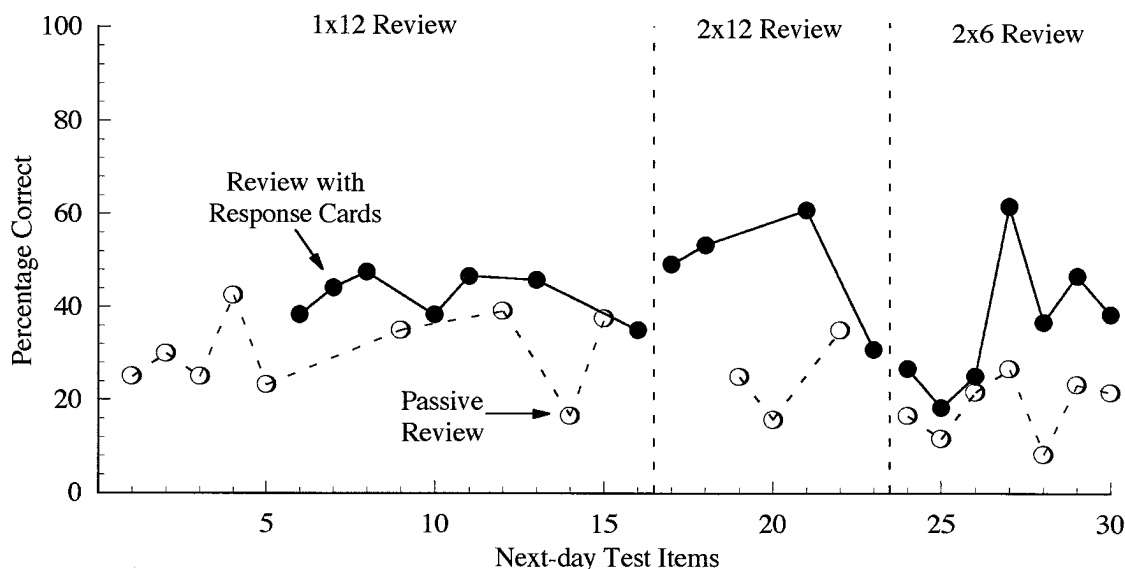


Figure 1. Mean percentage of next-day test items answered correctly by all students during passive and response card review conditions.

### Weekly Tests

Students' scores on weekly tests were also higher for items that had been reviewed with response cards. Mean percentage correct on all weekly tests for all students for items reviewed with the passive and response card procedures during the  $1 \times 12$ ,  $2 \times 12$ , and  $2 \times 6$  review formats were 21% and 30.2%, 22.2% and 33.25%, and 9.7% and 12.5%, respectively.

Although inclusion of 12 new key points in each lesson effectively controlled for ceiling effects, it limited (a) the time available for each point during the lesson and (b) the time available for the end-of-lesson review, two factors that probably contributed to the low absolute scores on the next-day and weekly tests. The relative differences in students' recall of key points reviewed with the two procedures, however, demonstrate the critical importance of providing students with opportunities to respond actively to lesson content (Greenwood, Delquadri, & Hall, 1984).

Test scores for items reviewed with response cards may have been higher for two

reasons. First, with response cards, each key point was reviewed via a complete and explicit three-term trial consisting of (a) a content-based antecedent, (b) an active (i.e., observable) response by every student, and (c) precise feedback. Passive review lacked two of these elements: an observable response by the students and contingent feedback. Second, during response card review, students made a written response to a printed antecedent, a condition that matched the stimulus conditions and response requirements of the next-day and weekly tests.

Response cards also provided important feedback to the teacher (Heward, 1994). On several occasions, the teacher indicated that what he had perceived to be an effective lesson was visibly contradicted when many students could not respond correctly during the response card review.

Students did not indicate a preference for one review procedure over the other. A majority of students, however, reported that they learned more than or the same as in other science courses and that they liked the class more than or the same as other science

courses. The teacher reported that the level of student attentiveness was greater during response card reviews; beginning each session with a test helped focus student attention and establish an orderly climate for each day's lesson.

Students were not pretested prior to the study. It is impossible, therefore, to establish for whom or to what degree lesson content was novel. This limitation may account for some variability within experimental conditions.

Future research on using response cards during lesson closure might seek to discover and analyze additional variables (e.g., use of write-on or preprinted response cards, number and sequence of learning trials per key point) that contribute to students' optimal recall and use of curriculum content.

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